REMARKS

Claims 1-27 are pending in the application. Claims 20-27 are withdrawn from consideration. Claims 1-19 are rejected and are at issue.

By this Amendment, the claims are amended to overcome the rejection under §112. These rejections ought be withdrawn.

Applicant traverses the rejection of claims 1-5 and 7-19 as anticipated by Kane U.S. Patent No. 6,369,404.

Claim 1, as amended, specifies a quantum device, comprising an electrically inert solid within which there is a charge qubit comprising a pair of dopant atoms having a net charge and an electric field having two potential wells. The two potential wells are located adjacent respective dopant atoms. The location of the net charge and electric field having two potential wells defines the logical state of the qubit. A first gate is located over a potential barrier between the two potential wells to control barrier height. At least one second gate is located to control relative shapes and sizes of the two potential wells.

Claim 1 is recast with the current amendments to define the structure of a charge qubit to more clearly distinguish over Kane. Particularly, Kane does not disclose or suggest a charge qubit. Kane is concerned with a mechanism to read out the spin of a spin qubit, in which the state of the qubit is determined by the spin. Kane does not envisage the possibility that a qubit could be defined in a two dopant atom system using net charge. Moreover, Kane does not envisage the logical state of such a qubit being defined by the location of the net charge in the

double-wall potential field created by such a system. Further, Kane does not disclose a qubit capable of being made with a fabrication position of more than 200 Å.

Kane does not disclose any novel qubit architecture. Instead, Kane is concerned with the read out of a known spin qubit. The state of such a qubit is determined by the spin of a donor ion. Kane's invention is a mechanism to read out the state of the spin of the donor ion by taking advantage of the relationship between the spin of that ion and the most remote electron orbiting it. These are related by the hyperfine interaction. The mechanism then uses the Pauli principle to allow transit of the most remote electron when the spin relationships between the electron and donor are correct. The mechanism involves an electron, with present spin, moving from a reservoir to the donor ion and exchanging spin with it. In certain circumstances involving the relative spin relationships, this can lead to the most remote electron moving as well. Detection of this movement confirms a particular spin relationship, and therefore the state of the spin qubit.

Kane describes (among others including a single donor system) a configuration with two donors and two donated electrons. Two A-gates above the pair of donors are operated to cause both donated electrons to move to one donor when the correct spin relationship is in place. An E-gate between them is operated to generate the reservoir of electrons, see col. 2, lines 10 and 11, under the insulating barrier to enable the read out mechanism.

Kane also discloses using the E-gate to control barrier height, see col. 10, lines 10-14, to stop unwanted transfer of electrons between a pair of adjacent donors using quantum computation. Also, the E-gate control is used in order to keep separation between donors in a large array, see col. 10, lines 40 and 41.

In contrast, the present invention, as defined by claim 1, is not concerned with read out or with spin qubits. The present invention is concerned with specifying a novel qubit in the form of a charge qubit which comprises a pair of dopant atoms having a net charge and an electric field having two potential wells, wherein the two potential wells are located adjacent respective dopant atoms; and wherein the location of the net charge in the electric field having two potential wells defines a logical state of the qubit. Such a charge qubit also has gates to enable, for instance, its operation and read out.

By this Amendment, the elements of the claims considered by the Examiner to specify intended use or field of use have been eliminated or recast to define structural differences between the claimed invention and Kane.

As is apparent, claim 1 is not anticipated by Kane, as Kane does not disclose each and every element of claim 1, arranged as in the claim. Moreover, Kane does not suggest the invention defined by claim 1. The spacing between donors is not that the invention achieves an unexpected result regarding the spacing stated in Kane, but that the physics of the two different types of qubits have important implications for fabrication. It is very difficult to fabricate, even today, at Å precision. The spin qubit of Kane requires less than 200 Å precision in fabrication to function. A significant advantage of the current invention is that it defines a charge qubit that can be fabricated with up to 200 nm precision and still function, an improvement of ten fold over the qubit of Kane. Therefore, any obviousness rejection would also be improper.

Claims 2-5 and 7-19 depend from Kane and are believed allowable for the same reasons therefor.

For the above reasons, claims 1-5 and 7-19 are believed allowable and withdrawal of the rejection is requested.

Applicants traverse the rejection of claim 6 as obvious over Kane.

Claim 6 depends from claim 5 and specifies that spacing between the P atoms is in the range of 20 to 100 nm. Claim 6 is not obvious over Kane for the same reasons discussed above relative to independent claim 1.

Withdrawal of the rejection is requested.

Reconsideration of the application and allowance and passage to issue are requested.

Respectfully submitted,

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F. William McLaughlin
Reg. No. 32,273

WOOD, PHILLIPS, KATZ,
CLARK AND MORTIMER
Citigroup Center, Suite 3800
500 W. Madison Street
Chicago, IL 60661-2562
(312) 876-1800